MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023 (TERM ID 2220)

PBM0054 – MATHEMATICS

(Foundation in Business)

3 JULY 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 2 pages with **FOUR** questions.
2. Attempt **ALL** four questions. The distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided. All necessary workings **MUST** be shown.

QUESTION 1

a. Express the following as a single logarithm and simplify the expression.

$$\left[ln\, z^{\frac{1}{5}}x^{\frac{3}{5}} + ln\, y^{\frac{2}{3}}z^{-\frac{2}{3}} - ln(16x^6y^{11}z^{-5})^{\frac{1}{4}}\right]$$

(6 marks)

b. i. By substituting $u = log_3 x$, solve the following equation:

$$(log_3 x)^2 - 2log_3 x = 3$$

(6 marks)

ii. Solve the following equation:

$$4^{3-x} = 7^{2x+1}$$

(5 marks)

c. The logistic growth function

$$P(x) = \frac{90}{1 + 272\, e^{-0.122x}}$$

models the percentage of people, $P(x)$, who are x years old with some coronary heart disease.

i. What percentage of 20-year-olds have some coronary heart disease? (2 marks)

ii. At what age (x) the percentage of some coronary heart disease 50%? (6 marks)
(Round your answer to the nearest integer.)

(Total: 25 marks)

QUESTION 2

a. Given $A = \begin{bmatrix} 3 & 2 \\ -5 & 7 \\ 6 & -1 \end{bmatrix}$; $B = \begin{bmatrix} 9 & -4 \\ -3 & -2 \end{bmatrix}$; $C = \begin{bmatrix} 1 & 2 & 4 \\ 1 & 0 & -6 \end{bmatrix}$.

i. Find $(C - 5A^T)^T - AB$. (6 marks)

ii. Find $B^{-1}C$. (5 marks)

b. Solve the following system of linear equations using the inverse of coefficient matrix.

$$\begin{aligned} x - 4y + z &= 16 \\ 2x + 8y - 5z &= -40 \\ x - y - z &= -3 \end{aligned}$$

(14 marks)

(Total: 25 marks)

Continued...

QUESTION 3

a. Find y' for the given functions and simplify the answers.

i. $y = \sqrt[3]{x^2 - 5x + 1} + 9x^{-2} - 4$ (5 marks)

ii. $y = (2x^3 - 1)^5(5 - 3x)^4$ (5 marks)

b. Find $y''(1)$ for the given function and simplify the answer.

$$y = (3x^4 - 2x)^3$$

(6 marks)

c. Given $f(x) = \dfrac{(4 - 3x)^5}{(2x + 1)^2}$.

i. Find $f'(x)$ and simplify the answer. (5 marks)

ii. Hence find the equation of the tangent line to the curve $f(x)$ at the point $x = 1$. (4 marks)

(Total: 25 marks)

QUESTION 4

a. Evaluate the following integrals.

i. $\int x^{-\frac{7}{2}}(2 - 15x^3)^2 \, dx$ (5 marks)

ii. $\int \dfrac{3x^3}{(9x^4 - 11)^{\frac{7}{4}}} \, dx$ (6 marks)

iii. $\int_2^3 30x^2 \sqrt[4]{5x^3 - 3} \, dx$ (8 marks)

b. After initiating an advertising campaign in an urban area, a satellite dish provider estimates that the number of new subscribers will grow at a rate given by

$$\frac{dN}{dt} = 154\, t^{\frac{2}{3}} + 37$$

subscribers per month where t is the ***number of months*** after the advertising begins. How many new subscribers $N(t)$, should be expected 1.5 years from now? Round your answer to the nearest integer. (6 marks)

(Total: 25 marks)

End of Paper